

Swaps

Chapter 7

Nature of Swaps

A swap is an agreement to exchange cash flows at specified future times according to certain specified rules

An Example of a “Plain Vanilla” Interest Rate Swap

- An agreement by Microsoft to receive 6-month LIBOR & pay a fixed rate of 5% per annum every 6 months for 3 years on a notional principal of \$100 million
- Next slide illustrates cash flows that could occur

Cash Flows to Microsoft

(See Table 7.1, page 149)

-----Millions of Dollars-----

Date	LIBOR Rate	<i>FLOATING</i> Cash Flow	<i>FIXED</i> Cash Flow	Net Cash Flow
Mar.5, 2004	4.2%			
Sept. 5, 2004	4.8%	+2.10	-2.50	-0.40
Mar.5, 2005	5.3%	+2.40	-2.50	-0.10
Sept. 5, 2005	5.5%	+2.65	-2.50	+0.15
Mar.5, 2006	5.6%	+2.75	-2.50	+0.25
Sept. 5, 2006	5.9%	+2.80	-2.50	+0.30
Mar.5, 2007	6.4%	+2.95	-2.50	+0.45

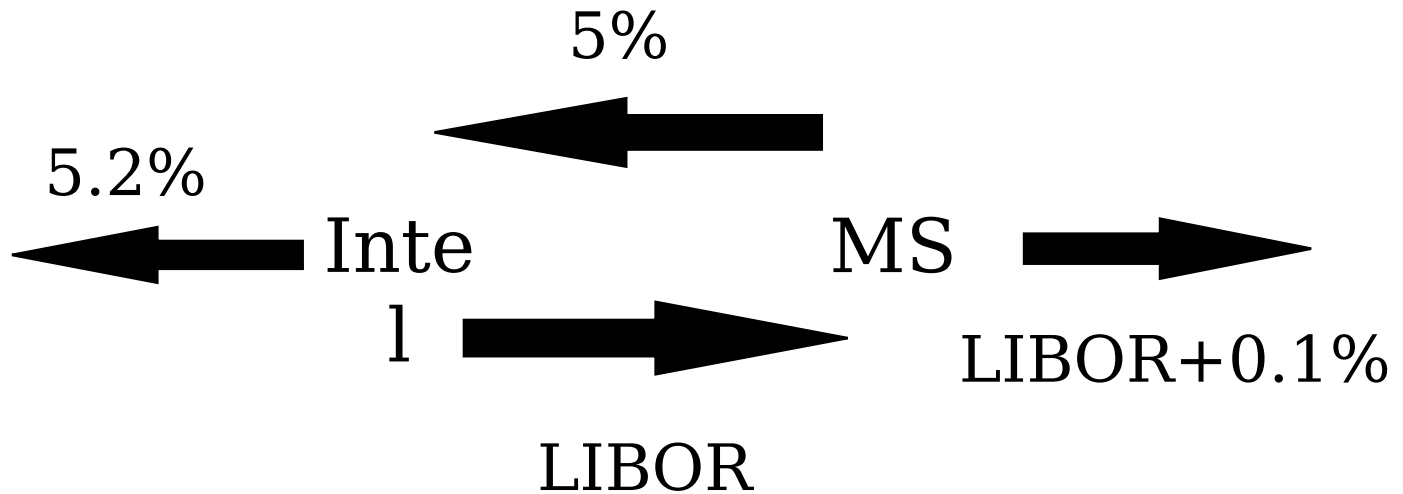
Typical Uses of an Interest Rate Swap

- Converting a liability from
 - fixed rate to floating rate
 - floating rate to fixed rate
- Converting an investment from
 - fixed rate to floating rate
 - floating rate to fixed rate

Intel and Microsoft (MS)

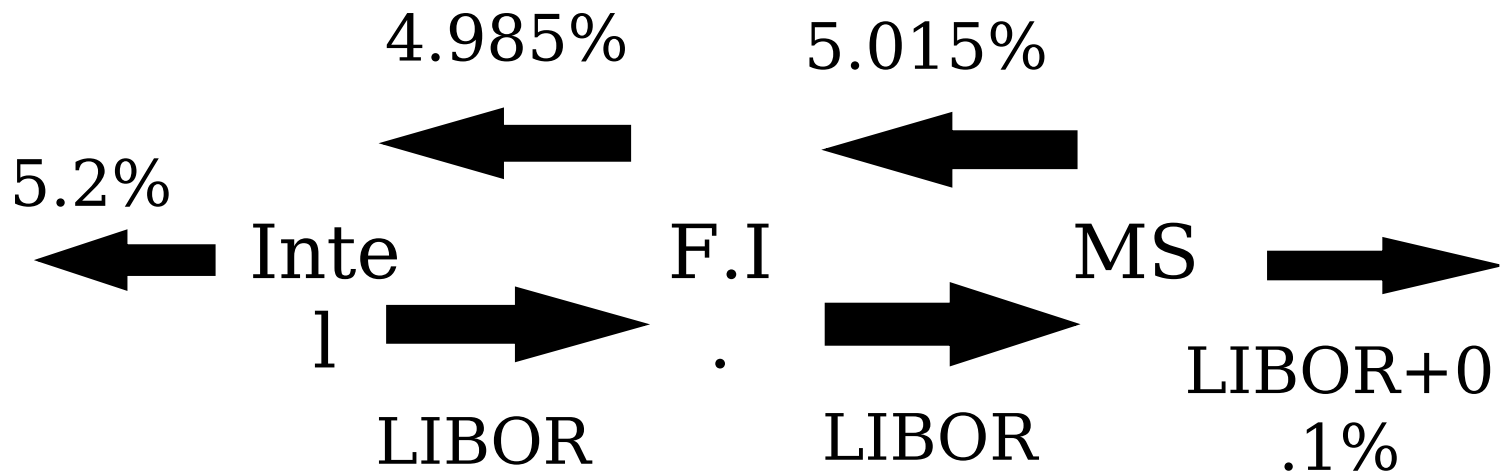
Transform a Liability

(Figure 7.2, page 150)



Financial Institution is Involved

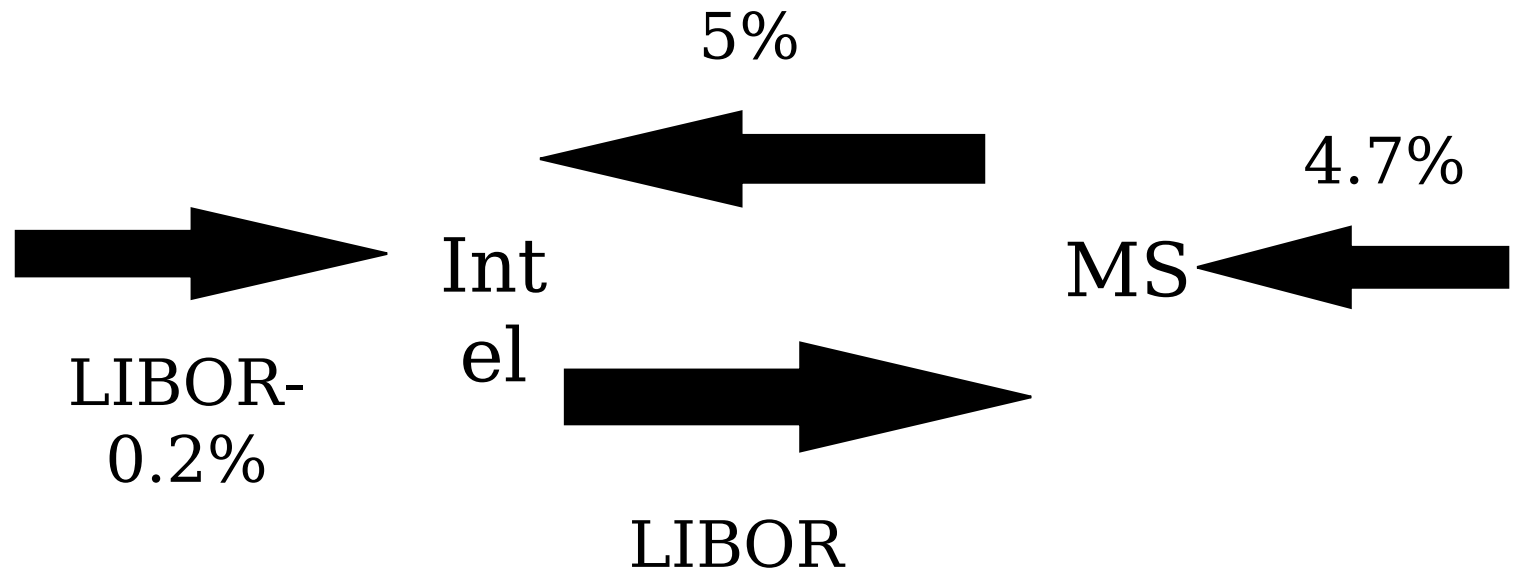
(Figure 7.4, page 151)



Financial Institution has two offsetting swaps

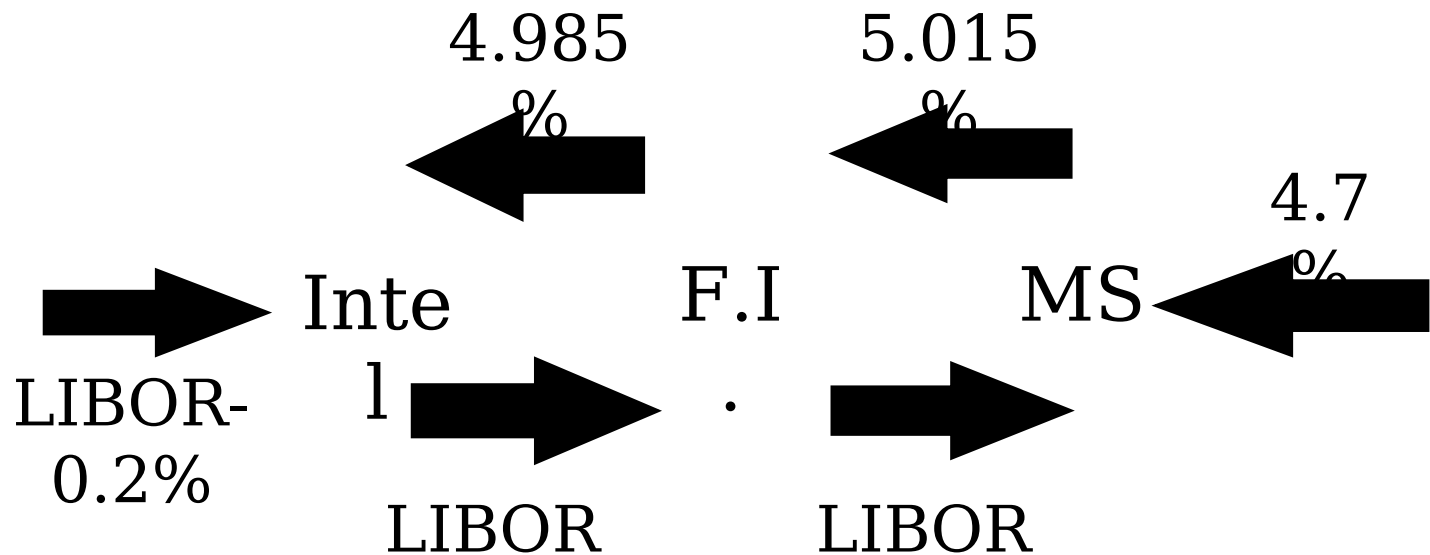
Intel and Microsoft (MS)

Transform an Asset (Figure 7.3, page 151)



Financial Institution is Involved

(See Figure 7.5, page 152)



Quotes By a Swap Market Maker

(Table 7.3, page 153)

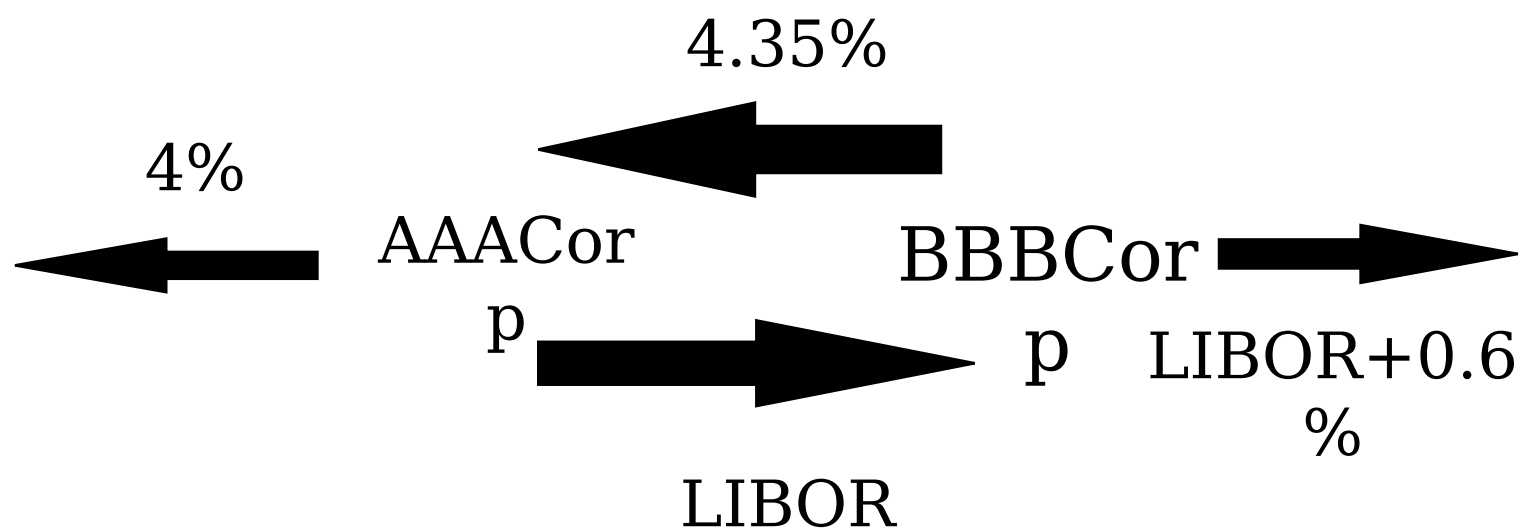
Maturity	Bid (%)	Offer (%)	Swap Rate (%)
2 years	6.03	6.06	6.045
3 years	6.21	6.24	6.225
4 years	6.35	6.39	6.370
5 years	6.47	6.51	6.490
7 years	6.65	6.68	6.665
10 years	6.83	6.87	6.850

The Comparative Advantage Argument (Table 7.4, page 155)

- AAACorp wants to borrow floating
- BBBCorp wants to borrow fixed

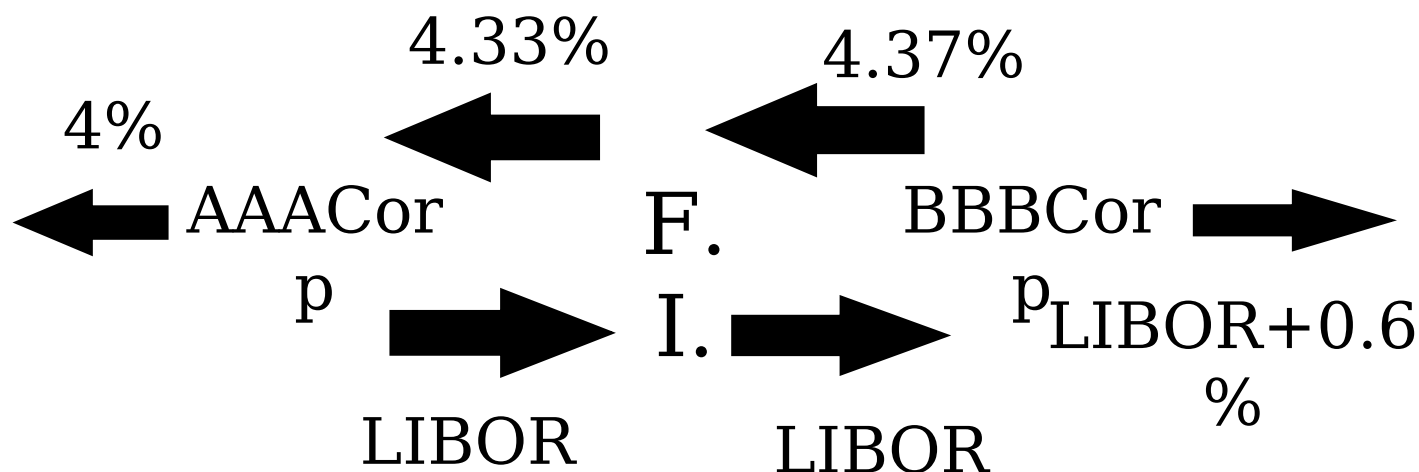
	<i>Fixed</i>	<i>Floating</i>
AAACorp	4.0%	6-month LIBOR – 0.10%
BBBCorp	5.2%	6-month LIBOR + 0.6%

The Swap (Figure 7.6, page 156)



The Swap when a Financial Institution is Involved

(Figure 7.7, page 156)



Criticism of the Comparative Advantage Argument

- The 4.0% and 5.2% rates available to AAACorp and BBBCorp in fixed rate markets are 5-year rates
- The $\text{LIBOR} - 0.1\%$ and $\text{LIBOR} + 0.6\%$ rates available in the floating rate market are six-month rates
- BBBCorp's fixed rate depends on the spread above LIBOR it borrows at in the future

The Nature of Swap Rates

- Six-month LIBOR is a short-term AA borrowing rate
- The 5-year swap rate has a risk corresponding to the situation where 10 six-month loans are made to AA borrowers at LIBOR
- This is because the lender can enter into a swap where income from the LIBOR loans is exchanged for the 5-year swap rate

Using Swap Rates to Bootstrap the LIBOR/Swap Zero Curve

- Consider a new swap where the fixed rate is the swap rate
- When principals are added to both sides on the final payment date the swap is the exchange of a fixed rate bond for a floating rate bond
- The floating-rate rate bond is worth par. The swap is worth zero. The fixed-rate bond must therefore also be worth par
- This shows that swap rates define par yield bonds that can be used to bootstrap the LIBOR (or LIBOR/swap) zero curve

Valuation of an Interest Rate Swap that is not New

- Interest rate swaps can be valued as the difference between the value of a fixed-rate bond and the value of a floating-rate bond
- Alternatively, they can be valued as a portfolio of forward rate agreements (FRAs)

Valuation in Terms of Bonds

- The fixed rate bond is valued in the usual way
- The floating rate bond is valued by noting that it is worth par immediately after the next payment date

Example

- Pay six-month LIBOR, receive 8% (s.a. compounding) on a principal of \$100 million
- Remaining life 1.25 years
- LIBOR rates for 3-months, 9-months and 15-months are 10%, 10.5%, and 11% (cont comp)
- 6-month LIBOR on last payment date was 10.2% (s.a. compounding)

Valuation Using Bonds (page 160)

Time	B_{fix} cash flow	B_{fl} cash flow	Disc factor	PV B_{fix}	PV B_{fl}
0.25	4.0	105.100	0.9753	3.901	102.505
0.75	4.0		0.9243	3.697	
1.25	104.0		0.8715	90.640	
Total				98.238	102.505

Valuation in Terms of FRAs

- Each exchange of payments in an interest rate swap is an FRA
- The FRAs can be valued on the assumption that today's forward rates are realized

Valuation of Example Using FRAs (page 162)

Time	Fixed cash flow	Floating cash flow	Net Cash Flow	Disc factor	PV B_{fl}
0.25	4.0	-5.100	-1.100	0.9753	-1.073
0.75	4.0	-5.522	-1.522	0.9243	-1.407
1.25	4.0	-6.051	-2.051	0.8715	-1.787
Total					-4.267

An Example of a Currency Swap

An agreement to pay 5% on a sterling principal of £10,000,000 & receive 6% on a US\$ principal of \$18,000,000 every year for 5 years

Exchange of Principal

- In an interest rate swap the principal is not exchanged
- In a currency swap the principal is usually exchanged at the beginning and the end of the swap's life

The Cash Flows (Table 7.7, page 164)

	Dollars	Pounds
	\$	£
Year	-----millions-----	
2004	-	
2005	18.00	+10.90
2006	+1.08	-0.50
2007	+1.08	-0.50
2008	+1.08	-0.50
2009	+19.08	-10.50

Typical Uses of a Currency Swap

- Conversion from a liability in one currency to a liability in another currency
- Conversion from an investment in one currency to an investment in another currency

Comparative Advantage Arguments for Currency Swaps (Table 7.8, page 165)

General Electric wants to borrow AUD
Qantas wants to borrow USD

	USD	AUD
General Motors	5.0%	7.6%
Qantas	7.0%	8.0%

Valuation of Currency Swaps

Like interest rate swaps, currency swaps can be valued either as the difference between 2 bonds or as a portfolio of forward contracts

Example

- All Japanese LIBOR/swap rates are 4%
- All USD LIBOR/swap rates are 9%
- 5% is received in yen; 8% is paid in dollars. Payments are made annually
- Principals are \$10 million and 1,200 million yen
- Swap will last for 3 more years
- Current exchange rate is 110 yen per dollar

Valuation in Terms of Bonds

(Table 7.9, page 167)

Time	Cash Flows (\$)	PV (\$)	Cash flows (yen)	PV (yen)
1	0.8	0.731 1	60	57.65
2	0.8	0.668 2	60	55.39
3	0.8	0.610 7	60	53.22
3	10.0	7.633 8	1,200	1,064.30
Total		9.643 9		1,230.55

Valuation in Terms of Forwards (Table 7.10, page 168)

Time	\$ cash flow	Yen cash flow	Forward Exch rate	Yen cash flow in \$	Net Cash Flow	Present value
1	-0.8	60	0.009557	0.5734	-0.2266	-0.2071
2	-0.8	60	0.010047	0.6028	-0.1972	-0.1647
3	-0.8	60	0.010562	0.6337	-0.1663	-0.1269
3	-10.0	1200	0.010562	12.6746	+2.6746	2.0417
Total						1.5430

Swaps & Forwards

- A swap can be regarded as a convenient way of packaging forward contracts
- Although the swap contract is usually worth zero at the outset, each of the underlying forward contracts are not worth zero

Credit Risk

- A swap is worth zero to a company initially
- At a future time its value is liable to be either positive or negative
- The company has credit risk exposure only when its value is positive
- Some swaps are more likely to lead to credit risk exposure than others
- What is the situation if early forward rates have a positive value?
- What is the situation when the early forward rates have a negative value?

Other Types of Swaps

Floating-for-floating interest rate swaps, amortizing swaps, step up swaps, forward swaps, constant maturity swaps, compounding swaps, LIBOR-in-arrears swaps, accrual swaps, diff swaps, cross currency interest rate swaps, equity swaps, extendable swaps, puttable swaps, swaptions, commodity swaps, volatility swaps.....